Multi-Label Emotion Classification Using NLP

This project aims to build an emotion classifier using the GoEmotions dataset, which includes human-labeled Reddit comments annotated for 27 emotion categories. The goal is to develop a model that can accurately classify text into one of these emotions, which can be applied to analyzing social media comments, reviews, or even customer feedback to detect emotional tone.

Business Understanding

Enhance Customer Experience

Recognize and address customer annoyance or discontent (such as rage or grief) as soon as possible.

Improved Customer Assistance

Assign complaints and inquiries to the appropriate support staff automatically based on the emotional tone of the communication.

Customize Marketing

Create more effective and individualized outreach by incorporating customer emotions into communication methods or advertisements.

Data Understanding

1

Data Source

The GoEmotions dataset was sourced from Reddit, a popular social media platform where users post comments on various topics.

2

Data Annotation

The comments were manually annotated by human labelers into 27 distinct emotion categories (such as joy, anger, sadness, curiosity, and more).

3

Data Characteristics

The dataset was created by Google Research as part of their efforts to advance Natural Language Processing (NLP) research, ensuring a wide variety of topics and emotional expressions.

Objective

1

Multi-label Emotion Detection

Predict one or more emotion categories for each Reddit comment from the 27 possible emotion classes.

2

Handling Noisy Text

Effectively preprocess the text (e.g., dealing with slang, abbreviations, and varied sentence structures in Reddit comments) to ensure accurate predictions.

3

Accurate Classification

Maximize the model's performance on key metrics for multi-label classification (such as F1-score, precision, and recall) across all 27 emotion categories.

Applications

Social Media Monitoring

Understand public sentiment on platforms like Reddit, Twitter, and Facebook.

Customer Feedback Analysis

Detect emotional tone in product reviews or customer support conversations.

Mental Health Monitoring

Detect signs of distress or mental health issues in text-based communications on forums or in private messages.

Expected Outcome

Input

A Reddit comment

Output

One or more emotion labels (from the 27 possible emotions) that best represent the emotional tone of the comment.

Accuracy

Train a machine learning model with an accuracy of 85% and above.

Modeling and Evaluation

1

Data Preprocessing

Clean and preprocess the text data, including removing emojis, punctuation, and stopwords, and performing lemmatization.

2

Model Training

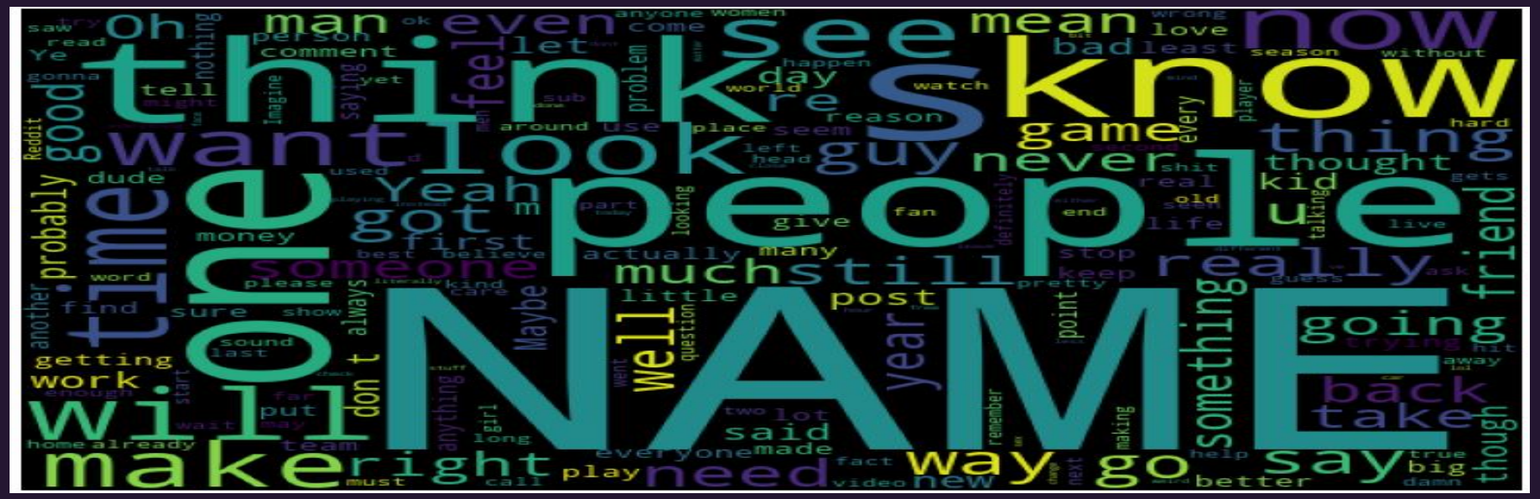
Train a Convolutional Neural Network (CNN) model on the preprocessed data, using techniques like class balancing and early stopping.

3

Model Evaluation

Evaluate the trained model's performance on the test set, focusing on metrics like accuracy, precision, recall, and F1-score.

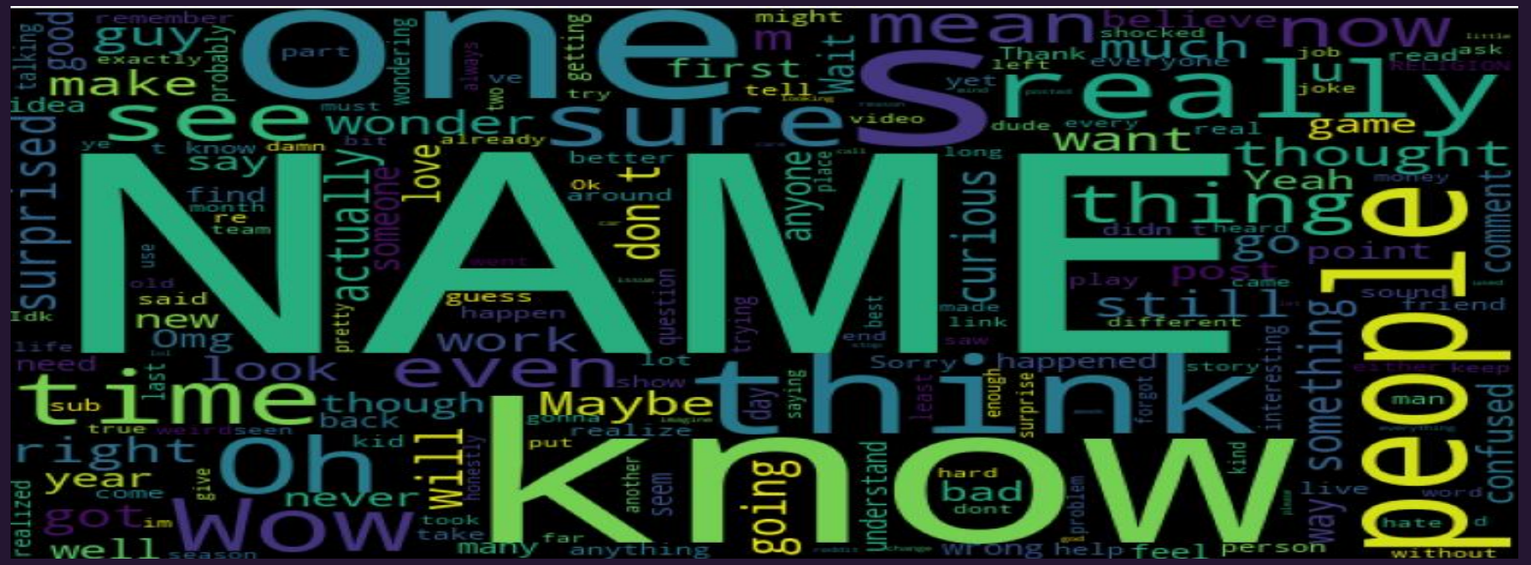
Neutral Word Cloud



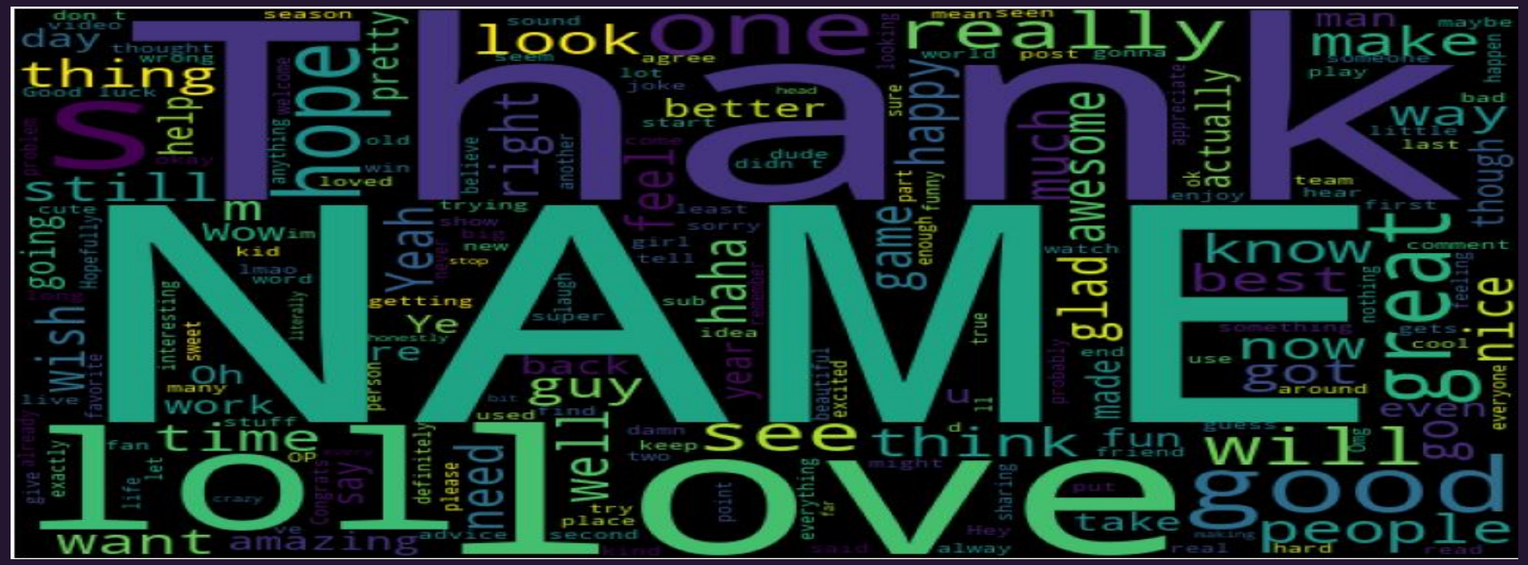
Anger World cloud

Fear Word Cloud

Surprise World cloud

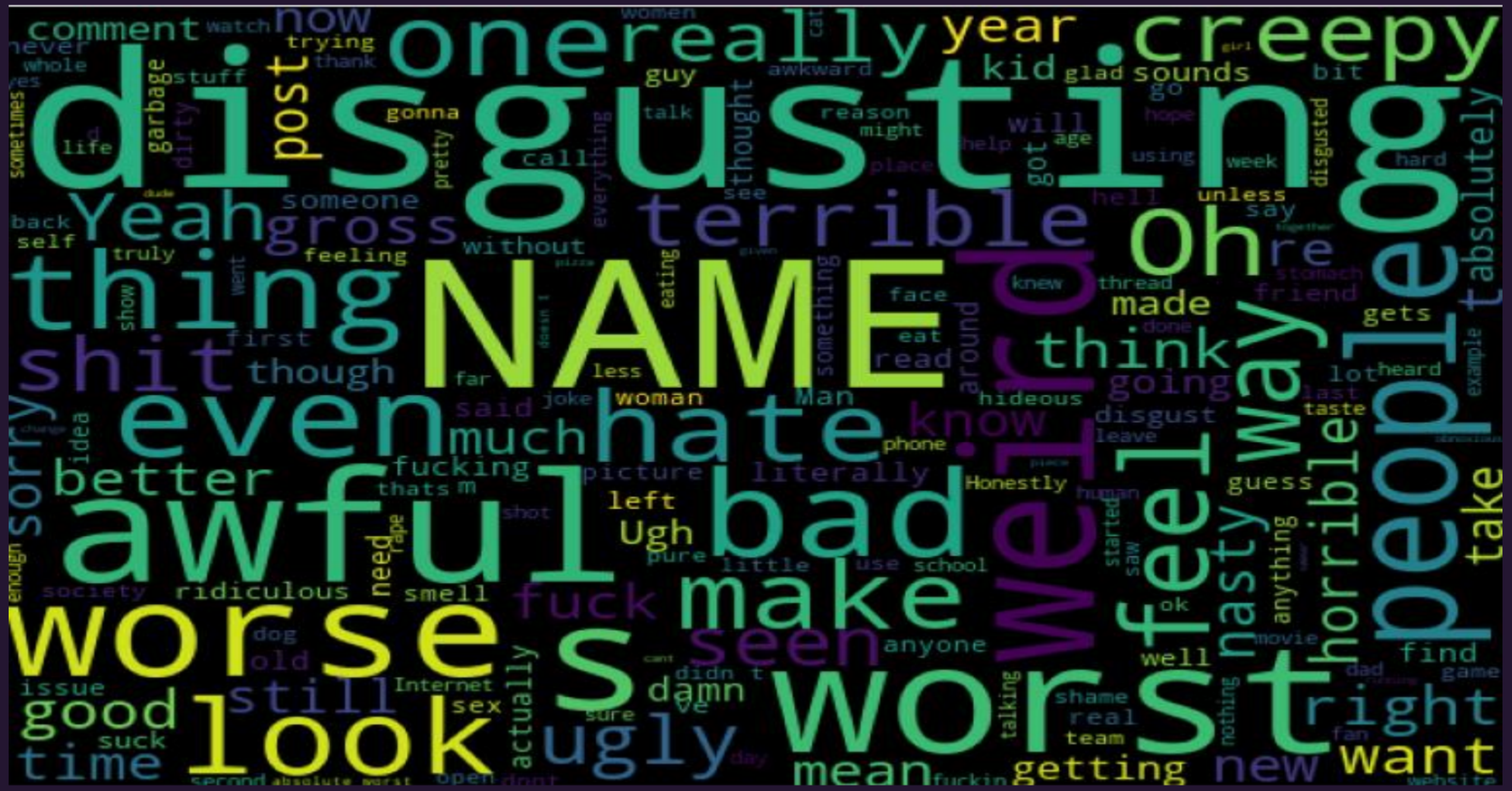


Joy Word Cloud

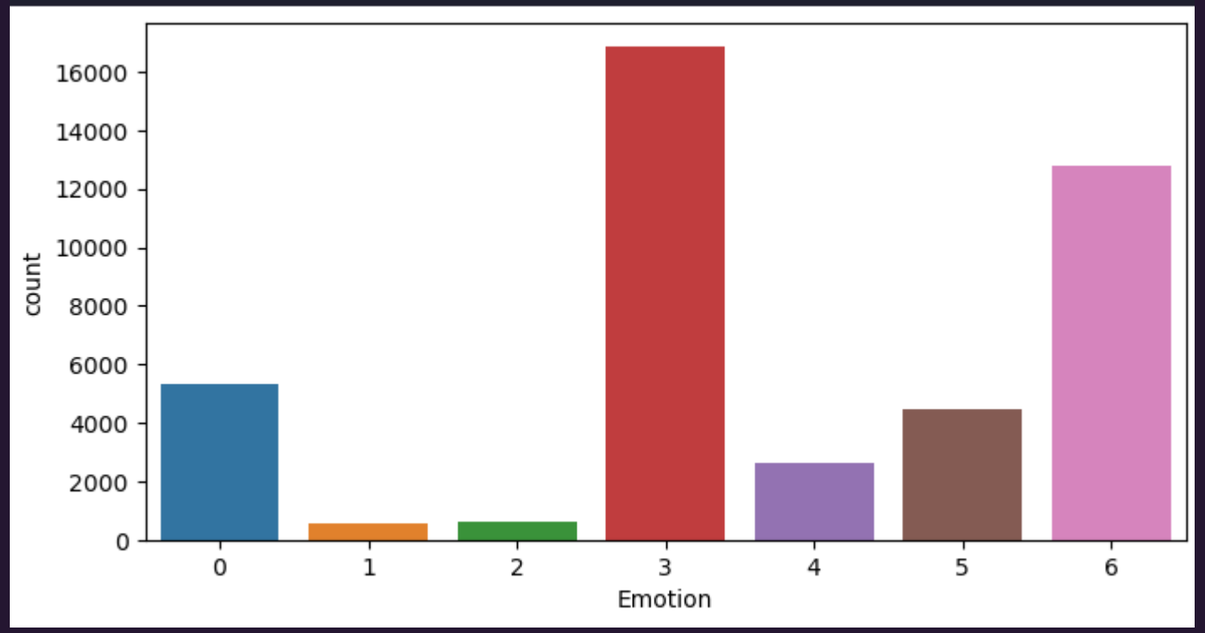


Sad World cloud

Disgust Word Cloud



Distribution of Emotions



Training Data Distributions

Index :

"anger":0

"disgust":1

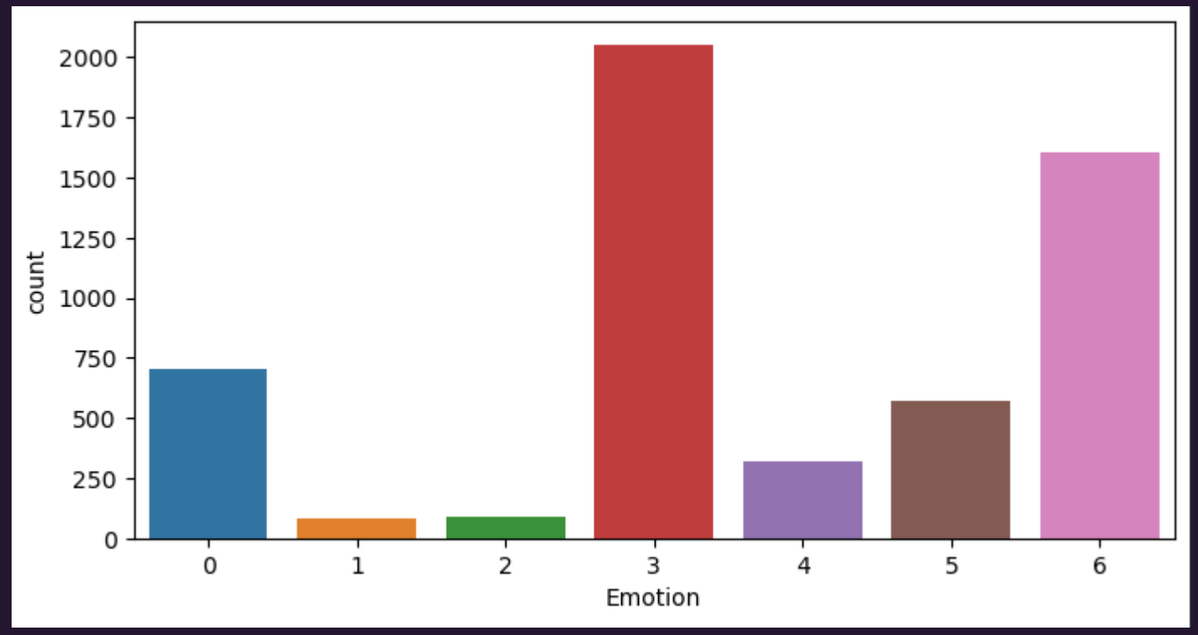
"fear":2

"joy":3

"sadness":4

"surprise":5

"neutral":6



Test Data Distribution

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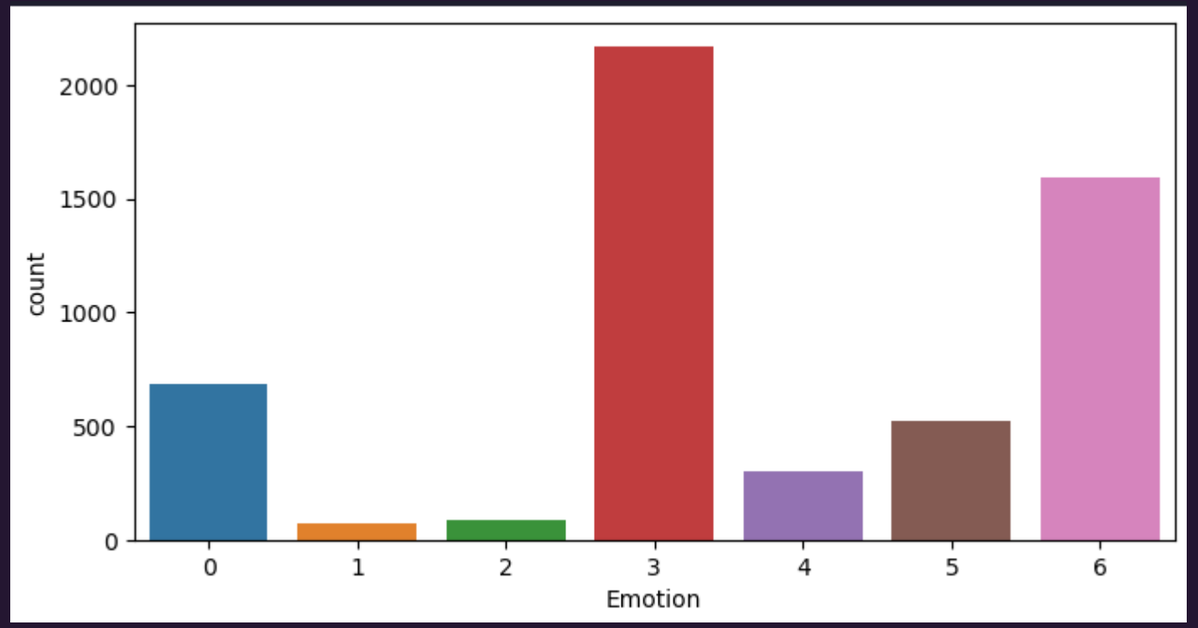
Distribution of Emotions



Dev Data Distributions(Validation)

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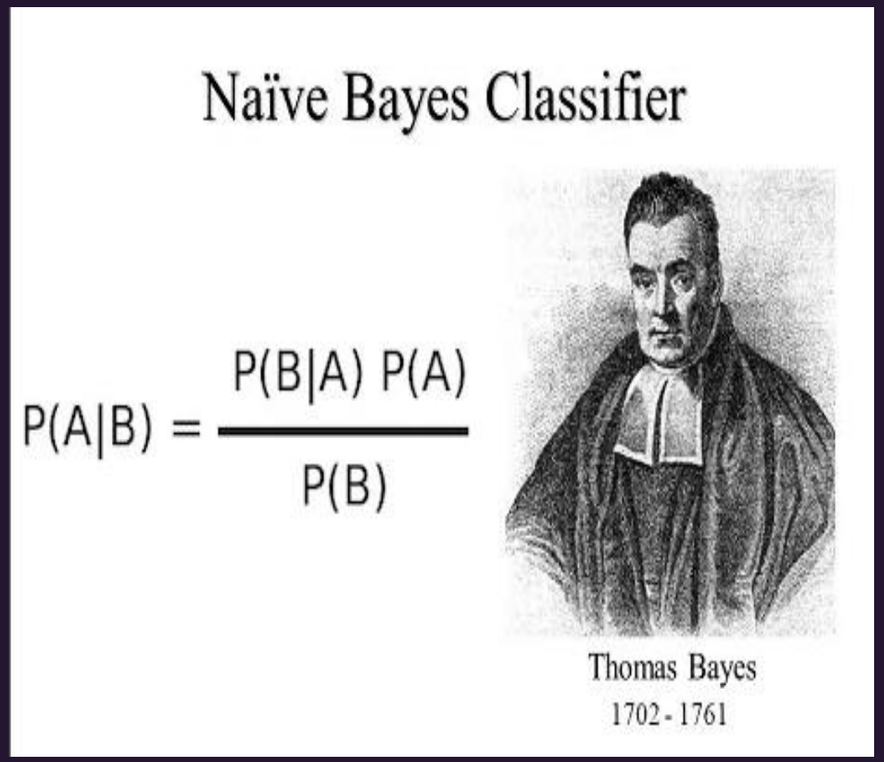
Modeling and Evaluation

1

Naïve Bayes classification

Naive Bayes Training Accuracy: 66.64%
Naive Bayes Test Accuracy: 52.19%

Analysis:
Accuracy:
•Training accuracy: **0.556** (55.6%)
•Testing accuracy: **0.556** (55.6%) Both training and testing accuracy are quite similar, which suggests that your model is not overfitting but may have issues with generalization and learning from the data.



Modeling and Evaluation

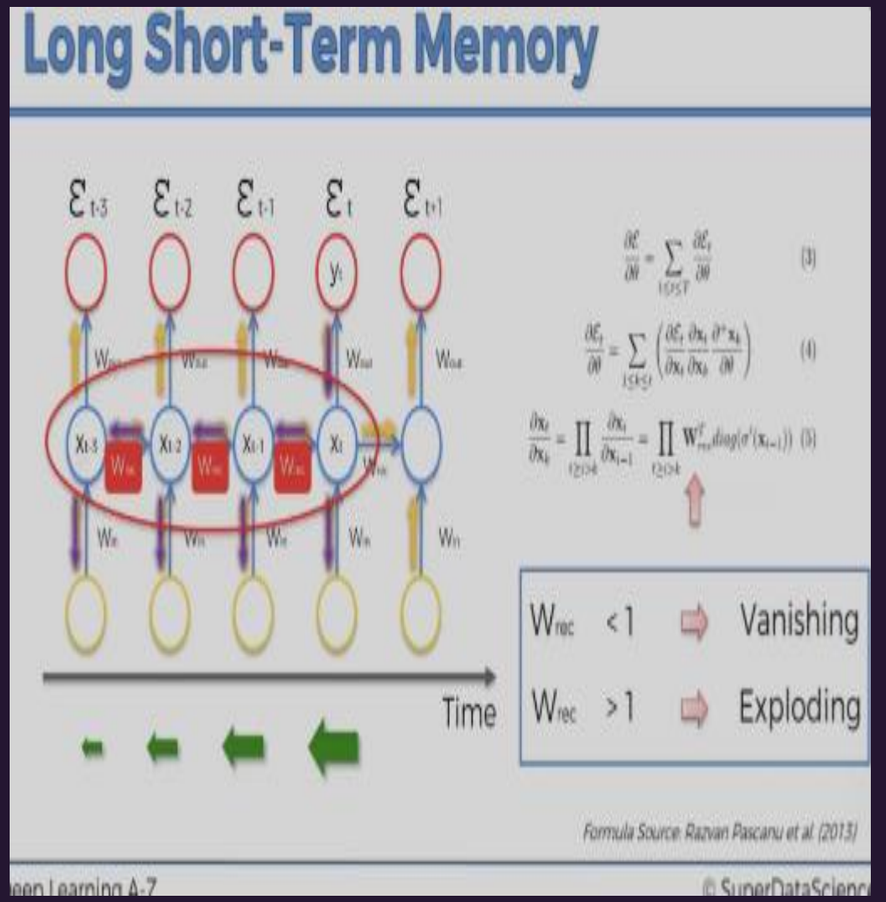
2

LSTM (Long Short-Term Memory)

Neural Network Testing Accuracy Score: 0.5569997292174383 Neural Network Training Accuracy Score : 0.5569997429847717

Analysis
Precision:
A greater precision means that the positive class predictions contain fewer irrelevant cases.
An illustration of Class 1 (likely neutral):
Precision: 0.66, implying that 66% of the cases predicted as Class 1 were indeed Class 1.

Recall:
A higher recall shows that the model catches more true instances of the positive class.
Example for Class 3 (maybe happiness):
Recall: 0.83 indicates that 83% of real Class 3 occurrences were recognized correctly.



Modeling and Evaluation

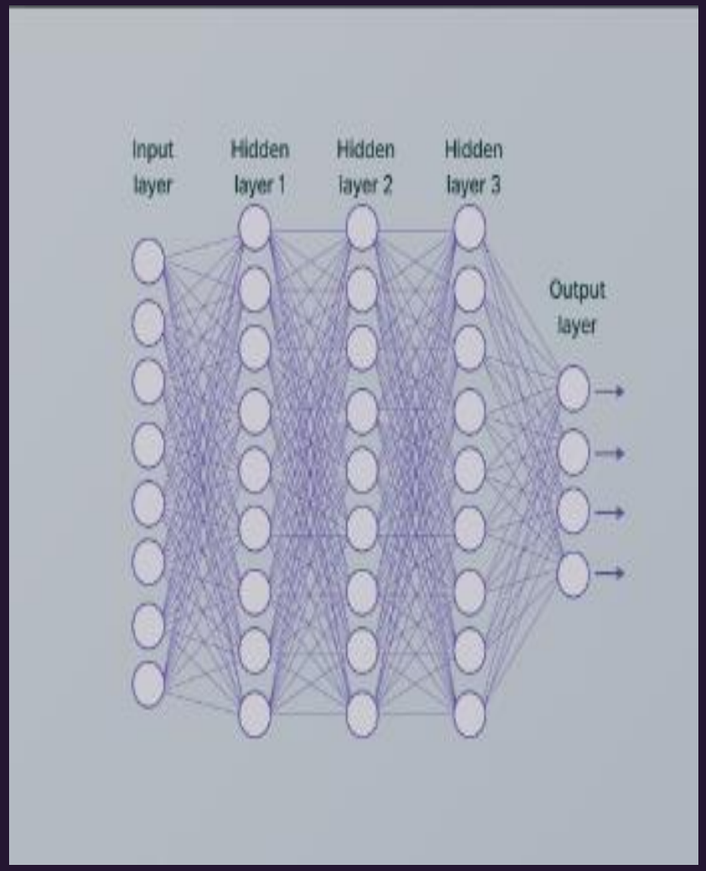
3

CNN (convolutional Neural Network)

Neural Network Testing Accuracy Score: 0.5569997292174383 Neural Network Training Accuracy Score : 0.5569997429847717

Analysis:
*** Loss Decrease:**
The loss consistently decreases over the epochs, which indicates that the model is learning. A decreasing loss means the model is improving its predictions on the training data.

*** Accuracy Improvement:**
The accuracy improves with each epoch as well. Starting at about 74.83% and ending at 84.49 % indicates that the model is becoming more accurate in its predictions.



Recommendations

Align with Business Objectives

Ensure the model's performance aligns with the company's specific needs, such as prioritizing precision or recall based on the use case.

Constant Maintenance

Periodically assess the model's performance and retrain it to adapt to evolving business needs, ensuring the model remains effective over time.

Model Explainability

Make the model's outputs interpretable, especially in regulated industries, using techniques like Grad-CAM or LIME.

Recommendations (cont):

Update and Monitor:

After deployment, periodically assess the model's performance and retrain it to adapt to evolving business needs. the Model which can be used make a chatbot Assistant

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Conclusions :

We Decided to use CNN , In a business scenario, the objective is to guarantee that the CNN contributes quantifiable benefit to company outcomes in addition to attaining high accuracy. Prioritize guaranteeing scalability, cost-effectiveness ,explainability for stakeholders, and matching model performance to business objectives.
You can optimize the model's effect on the company by keeping an eye on it and making improvements all the time.

Thank You :

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